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Boron Fuel Program

Defense Secretary Neil McElroy's blunt warning that marginal missile and aircraft programs will "disappear" (SCIENCE TRENDS Aug. 10) has taken on new emphasis with cancellation of much of the Air Force-Navy boron fuel program, and other actions planned for announcement in the next few weeks.

The Navy found boron too hazardous for carrier operations, while the Air Force belatedly learned that production costs would override any advantage in speed or range. These conclusions were reportedly reached or supported by the Pentagon's Weapon Systems Evaluation Group.

Cancellation of the projects may not necessarily mean the end of planning for the F-108 long range interceptor or the B-70 "chemical bomber" but will bring a re-evaluation of both projects. The B-70, in particular, is now ahead of schedule and may survive cutbacks.

Pentagon authorities believe that the boron fuel decision may actually brighten the outlook for two other projects which have been more or less in a state of limbo in recent months. They are:

* Dynasoar: Should the B-70 program be cut there would be an urgent need for a high-speed manned bomber. Dynasoar I and II, with orbital bombing capabilities, could presumably be the Air Force "follow-on" program. Action on this is expected shortly.

* Project Pluto: This is the AEC nuclear ramjet program which has struggled along on minimum funding for several years. Technical progress in recent months has been encouraging and may be stepped up by new funds. It had been thought in some circles that boron-based fuels would provide superior ramjet performance.

Project Tepee

Navy developments in the field of detection through ionospheric back scatter may eventually supplement existing methods of electronic surveillance and warning but will not replace these, according to Pentagon sources. The method, though ingenious, is said to be susceptible to electronic countermeasures and natural ionospheric disturbances.

Soviets have done considerable work in this field. Typical recent examples are a discussion of ionized particles following atomic explosions and a technical paper on "reverse-inclined" soundings of the ionosphere.

Aircraft Fuel Flow Systems

National Bureau of Standards, in a program sponsored by the Navy Bureau of Aeronautics, is verifying the accuracy of flowmeters used in the test and adjustment of modern aircraft engines. Research is also going forward in an attempt to find devices capable of more accurate flow measurements at the manufacturing level.

Reference Facilities - The NBS operates calibration apparatus accurate to two-tenths of one percent or better for liquid hydrocarbon flow rates in the 20 to 100,000 pounds per hour range. In addition studies are being conducted of flowmeters that may be suitable for use as transfer references for the accuracy evaluation of flowmeter calibrators at manufacturing locations. To prove satisfactory, such meters should have a repeatability of plus or minus one-tenth of one percent or better. All factors which may influence performance must also be known and controlled.

Flowmeters - NBS finds the glass-tube, variable-area type flowmeter fairly adequate for reference work in the range of 20 to 20,000 lb./hr.

For measurements in the range of 2,000 to 100,000 lb./hr. and up the turbine or propeller-type meters are said to be reasonably satisfactory. The turbine meter, used extensively in aircraft work, consists of a tubular section of pipe, threaded at each end, for convenient insertion into the fuel line. A small, many-vaned rotor having a velocity of rotation proportional to the volume flow rate is located within. Imbedded in the wall is a magnetic coil which senses the rotation rate and generates electrical pulses which are converted to either flow rate or total flow by appropriate readout instrumentation.

The Bureau's experience indicates that extremely precise results can be obtained on these meters only with low-viscosity liquids. When lubricating or hydraulic oils or other high viscosity liquids are used, the Bureau believes that positive displacement and orifice meters provide superior results.

Flowmeter Calibration - Considerations affecting flowmeter performance include density, viscosity and temperature of the liquid; flow disturbances and vapor pressures, with resulting cavitation and loss of liquid by evaporation. The Bureau finds that the effects of density can usually be determined by mathematical analysis. Viscosity effects, which are especially pronounced in the smaller size meters, can generally be established only through calibration study. The Bureau has met with some success in meeting upstream flow disturbances which originate within the pumps and supply piping. Flow straighteners containing bundles of small tubing are placed in a larger tube connected to the entrance of the meter under test.

Evaluation Programs - In addition to seeking more suitable transfer flowmeters the Bureau intends to evaluate newly developed flowmeters for telemetering, computer, and automatic recording and control applications.

Army Energy Requirements

Changing patterns in Army planning and tactics will bring about new requirements for energy supplies, according to Lt. Gen. Arthur G. Trudeau, Chief of Research and Development. Projects are going forward to derive increasing amounts of energy from both recognized and advanced sources. (For a summary of Navy energy requirements see SCIENCE TRENDS, Aug. 3, 1959.)

* General Requirements -- These criteria are being followed in evaluation of energy programs:

  - o Power sources in general must be mobile, rugged, noiseless, reliable and capable of operating under wide climatic variations.

  - o Power sources in some cases must include self-contained energy sources. Often these must have very long shelf life or standby life. However, from many, the power requirements will be modest.

  - o Fuels better than the hydrocarbons are badly needed but the Army believes that for many uses it is unlikely the hydrocarbons will be entirely replaced.

  - o The Army requires a family of silent units of light weight and high reliability to deliver 1 to 100 kw, preferably not using hydrocarbons or other fossil fuels and in any cases where these fuels are employed, using them with much higher efficiency and lower noise factor than at present.

* Batteries: Reorganization of Army units will have an effect on battery power requirements. Battalions generally require a three-day supply of battery power for various purposes. Previously, resupply has come from Army regiments. Under new planning, battalions will be independent battle groups carrying their own supplies. This means that, on the average, the combat soldier will require at least five times the energy he presently carries with him as batteries. With plans advancing to have a soldier carry a built-in communication system in his uniform there must be a drastic reduction in size and an increase of efficiency in power sources.

* Combat Surveillance: These devices include atomic detectors, airborne drones, radios, infrared, television cameras and others used to locate targets, assess damage, identify enemy traffic routes and vehicles and determine friend or foe. Devices to be spread over substantial areas in frontage and depth will require an average power output of about 150 watts for linkage to a central data collection and processing installation. Long built-in shelf life is also required. Similar units will be required for remote weather reporting stations.

* Hydrocarbons: A study by the Advanced Research Projects Agency concluded that gasoline is still the best possible fuel for use on the battlefield. However, the fact that some 60 percent of the tonnage required for combat operations is in fuels leads the Army to seek "something better." If possible hazards, particularly under battle conditions, can be overcome, advanced nuclear fuels may be utilized. Studies of chemical sources such as the Boranes and, for some applications, the use of an aluminum-fluorine combination is said to appear promising.

FREE GOVERNMENT PATENTS

Here is a new listing of government-owned patents now available for use by industry on a royalty-free basis. Subscribers desiring further information may write Service Department, Washington Science Trends, 1120 National Press Building, Washington 4, D.C. Inquiries will be directed to the appropriate Government Agency. There is no charge for this service.

( ) Wiretap Detector: The detector furnishes a warning to a telephone user of any attempt to listen surreptitiously to sounds occuring near a telephone microphone. Device uses a relay, rectifier bridge and an amplifier in the telephone circuit. A change in current flow indicates a wire-tap.

( ) Flame-Resistant Textiles: Under this patent cellulosic textile materials are made flame-resistant by impregnation with a solution containing tris(1-aziridinyl) phosphine oxide and urea. The material is then dried and heated at about 100 to 160°C. for from 2 - 10 minutes.

( ) Crystal Growing System: Crystals are grown from a nutrient system which circulates in contact with excess solid salt. As the crystal removes salt, the loss is compensated for by adding additional solute.

( ) Reduction Gearing System: This patent employs a balancing system for taking up torque and thrust leads imposed on the gearing. The gear train consists of two or more offset shafts that transmit power from an input gear mesh to an output gear mesh. Roller bearings are said to provide free axial movement.

( ) Plastics: This plastic composition is said to be stable against exudation of a plasticizer. A mixture of vinyl chloride polymer and a vinyl-chloride-vinyl acetate copolymer and a plasticizer are used. The process can make use of cottonseed oil supplies.

( ) Trepanning Apparatus: Holes can be cut on titanium alloys with this device - an adaptation of a unit designed to bore a rotating workpiece by trepanning. A stream of high pressure oil is directed upon the cutting tool to dissipate heat and reduce friction.

( ) Electrical Impulse Recording: This patent covers a stylus used in making marks on carbon coated paper in response to electrical impulses. A fine line or dot is said to be obtained by using a tungsten point. A block of non-conductive material holds a stainless steel rod and the tungsten rod.

( ) Adjustable Locking Coupling: Proper phase adjustment, as is required in coupling two analyzers, is said to be assured with this device. The coupling is angularly adjustable to the phase relationship between a pair of inline rotary shafts.

( ) High-Potential Insulating Device: This unit is for the suspension of an electrical conductor from a main supporting structure. It uses a torus-shaped corona ring which is attached to the insulator.

RESEARCH CHECKLIST

( ) New IFF Antenna: Navy has developed a new IFF (Identification Friend or Foe) antenna characterized by highly directive radiation patterns. The so-called FOX antenna is of a folded pillbox design with a 180° E plane bend along a parabolic surface. The feed is in one layer of the pillbox, with the aperture in another. The design is said to eliminate the need for a complex multiple-feed harness. It can be fabricated without precision construction to normal sheet-metal tolerances and with lightweight but rugged aircraft-type construction.

(R&D by the Naval Electronics Laboratory, San Diego, Calif.)

( ) Uranium Research: U.S. Bureau of Mines is currently investigating possible commercial applications of depleted uranium. Laboratory projects include investigations of the use of depleted uranium for cathodic protection, as an ingredient in bearing materials, as a heavy medium in mineral separation, as a constituent in high-strength steels, and as a catalyst in refining shale oil.

( ) Hot Die Press Forging: Air Force sponsored studies are said to make possible better and more economical forgings for a variety of applications through a new "hot die" forging technique. A commercial alloy was selected and a new foundry-molding system was developed employing a moldable graphite mixture. The system produced a gas-free, strong die with a surface requiring no further machining.

(Further information available from H. Hartley, Armour Research Foundation, 25 West 33rd St., Chicago 16, Ill.)

( ) Thin-Film Measurements: A toolmaker's microscope is being employed by the Naval Research Laboratory for the accurate measurement of thin evaporated films of metals and various other substances. Results are said to be consistent and comparable to the same kind of measurements made on much more elaborate and costly equipment.

(R&D by Electron Tube Engineering Section, Electronics Division, U.S. Naval Research Laboratory, Washington 25, D.C.)

( ) Transducer Research: Studies for the Atomic Energy Commission by the Sandia Corp. include experiments with high voltage one-shot ferromagnetic explosive-electric transducers. It was shown that such a transducer can provide a high voltage supply of over 100 kv. The most promising method for increasing efficiency and reducing size is said to be the use of several small cores in series. These could be arranged around an explosive to take advantage of the entire shock wave.

(Report available. 22 pages. 75 cents. Write OTS, U. S. Department of Commerce, Washington 25, D.C. for SCTM 229 -57 (51))

Publication Checklist

( ) CBR Warfare: Testimony from the Army on plans,programs and policies involving Chemical, Biological and Radiological warfare. Includes a censored version of statements delivered to a Congressional Committee in closed session. 44 pages. Single copies free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D.C. for CBR Hearings - No. 22)

( ) Radioactive Waste Disposal: Testimony, statements and exhibits on the problem of industrial radioactive waste disposal. Statements from more than 30 scientists and some 50 papers submitted for the record. App. 3,000 pages. Single copies free. (Write Mr. James T. Ramey, Executive Director, Joint Committee on Atomic Energy, Room F-88, The Capitol, Washington 25, D.C. for Radioactive Waste Disposal, Volumes I-IV)

( ) Inventions: A new Government guidebook designed to help inventors decide whether to apply for patents, and where to obtain patent information. Includes related information on marketing. 15 cents. (Write Supt. of Documents, Government Printing Office, Washington 25, D.C. for "Patents and Inventions")

( ) Military Air Transportation: Hearings before Congress on this always-controversial subject. Includes much background material. 246 pages. Single copies free. (Write Committee on Government Operations, U.S. House of Representatives, Washington 25, D.C. for Hearings - Military Air Transportation)

( ) Glass and Glass Products: A new catalog of technical reports available from the Government covering various research projects on glass and glass products from 1930 to 1958. Single copies free. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for CTR-370)

( ) Food Irradiation: a new catalog of technical reports available from the Government dealing with research and development in the field of radiation preservation of food during the period 1951-1958. Single copies free. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for CTR-357)

( ) Refined Metals: A report describing vacuum distillation tests on a magnesium-base incendiary alloy to determine the feasibility of recovering magnesium and cadmium as refined metals. 17 pages. Single copies free. (Write Publications Distribution Section, U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5476)

( ) Satellite and Space Operations: A lecture series by experts presented by the Office of Naval Research, April-July 1958. Includes material on space navigation and celestial mechanics, satellite tracking, satellite payloads, space communications and similar subjects. 111 pages. $2.50. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 410)